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California State University

San Bernardino

DEVELOPMENT OF COURSE OUTLINES FOR A
MAINTENANCE TECHNICIAN TRAINING PROGRAM

A Project Submitted to
The Faculty of the School of Education
in Partial Fulfillment of the Requirements of the
Degree of Master of Arts

in

Education: Administration of Vocational Education Option

by

George R. Conrad, M.A.
San Bernardino, California

1985

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Advisor

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Committee Member

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Developing Course Outlines for Maintenance Technician

George R. Conrad, M.A.

California State University, San Bernardino, 1985

Introduction

As our manufacturing capacity expands, the need for trained maintenance personnel increases at a steady rate. We have also simultaneously arrived in the age of high technology where computerized machines and robotics are being used to do the mundane jobs which were done by the unskilled only a few years ago. This sudden surge of technology has created a need for maintenance persons who have received training in a variety of skill areas.

The growing need for maintenance technicians requires educational institutions to come up with meaningful training for entry level maintenance personnel. The Riverside Office of Employment Development projects a need of at least 30 maintenance positions a year in the Riverside area with annual increases until at least the year 2000. The Dictionary of Occupational Titles lists 39 different maintenance positions from entry level through supervision.¹

As a result of this need, contact was made with various Riverside employers such as Rohr, Fleetwood, Bourn's, Corona Clipper, Toro, City of Riverside, and County of Riverside. The various personnel department people who were contacted indicated that their needs were for entry level people who had some training in general areas of knowledge. The supervisors in the maintenance areas of these companies

¹ The Dictionary of Occupational Titles, U.S. Department of Labor, Employment and Training Division. (Washington, D.C.: Government Printing Office, 1977) pp. 1062-3.

stated that additional training in specific areas would come later, after the company had the opportunity to observe the people and use them in positions where needs arose.

In anticipation of the training needs of these individuals, Riverside City College has indicated that they need to prepare specific courses to meet those requirements.

This project will provide course outlines to be used to train entry level maintenance technicians in the areas of Machine Shop, Air Conditioning and Refrigeration, Automotive (Industrial), Communications, Electrical, Hydraulics and Pneumatics, Math, and Welding.

Review of Literature

The review of literature revealed that course material for training of maintenance technicians is very difficult to find, because it has been developed on a regional basis and is not appropriate for the Riverside/San Bernardino area. Most of the material is developed as a program concept, where students receive their training in a program, rather than individual class offerings. Materials reviewed for this project were:

Mid-America Vocational Curriculum Consortium

Plant Engineering

Riverside City College Curriculum

Golden West College Curriculum

Vocational-Technical Education Consortium of States (Kentucky, Wisconsin)

The 1980 materials developed by the Mid-America Vocational is curriculum in a course format, that is the subject matter is written as a single course offering. The subject outlined is hydraulics and pneumatics, it is well developed but limited to a specific subject area not an actual maintenance program. The outline is used to familiarize the student with the subject through a series of lectures; no laboratory assignments are included.

Articles in Plant Engineering magazine address the concerns of large industries like Ford, General Motors, U.S. Steel and their specific applications in the maintenance of a large industrial factory. The articles have been written to assist those who have basic knowledge in the maintenance field to solve problems, such as large production applications in automated manufacturing, encountered by these firms

daily. Many of the articles cut across all the normal areas of maintenance, but also include much financial data, such as the cost savings in special high production of automobiles and steel processing, which can be used by maintenance managers to justify changes and modifications recommended for a specific industry. These articles tend to lack relevance for the small industries located in the Riverside/San Bernardino area because their production techniques are not as sophisticated as the large Eastern concerns.

The curriculum at Riverside City College was reviewed and found to contain classes in Machine Shop, Automotive, Air Conditioning and Refrigeration, and Welding, but not specifically taught to satisfy entry level training requirements. In some cases, minor modifications such as changes to train for maintenance positions rather than each area as its own specialty. To accomplish this, the classroom material has to become relevant to the maintenance of industrial equipment rather than dealing with consumer products found in the home.

Maintenance curriculum material used at Golden West College was developed to train entry level maintenance people, but in a program format. That is the student signs up for a program in maintenance technology and receives training in all areas, not in individual classes offered on a continuing basis. This type of training does not allow a student choice of class offerings nor can one specific class be used for upgrading of present job skills.

The material from the Vocational-Technical Education Consortium of States is well written and outlined in an excellent format. The only major objection is this material was developed to satisfy the needs of employers in the individual participating states. Many of

the large industrial firms in the Midwest have totally different requirements for mass production of cars, refrigerators, washers and other common consumer products. An example of this is the reference to each state's electrical and building codes which are not applicable in our area of Southern California.

Through this review of literature, it has become apparent that course outlines for maintenance technician training program of the type needed in Riverside/San Bernardino County are not readily available. Where the material is available, it will not suit the requirements of the local Riverside/San Bernardino area employers. This means each area must develop curriculum to suit individual needs based upon input from local employers. The Riverside area has extensive recreational vehicle manufacturing which demands specific needs while other local manufacturers have totally different job requirements. Since this is the condition under which a good maintenance technician training program has to be developed, this project shall accomodate as many of the basic needs as possible.

Statement of Objectives

The objective of this project is to develop course outlines for a Maintenance Technician Training Program. The courses can be used to establish a viable training program which will incorporate the basic needs of local Riverside industries. This project will include course outlines for eight classes as follows: Machine Shop, Air Conditioning and Refrigeration, Automotive (Industrial), Communications, Electrical, Hydraulics and Pneumatics, Math, and Welding. It should be pointed out that the course outlines are written in accordance with standard procedures used for approval by the curriculum committee at Riverside City College. A more detailed syllabus is written by each instructor to indicate how the class shall be taught over the length of a semester. An example of the type of detailed course outline that individual course instructors are expected to prepare has been included as a part of this project (Machine Shop 50).

Design of the Project

- I. The research of material and its evaluation was done to see if the type of training material required for use in the Riverside/San Bernardino County area was available and, if it were, how applicable it would be to satisfy the needs of local employers.
- II. The research of the proposed market was accomplished by contacting a variety of public agencies and private companies to verify their needs. After their needs were determined, it was then possible to develop a list of skills which should be taught to entry level people for placement in local companies and city and county government.
- III. Once the areas of concern were identified to be Machine Shop, Air Conditioning and Refrigeration, Automotive (Industrial), Communications, Electrical, Hydraulics and Pneumatics, Math, and Welding, it became necessary to develop course material for each of these areas. The outlines each include a course description describing course content and listing hours of lecture and laboratories per each semester. In addition, each course outline states the objectives that are to be met by students for each semester. Due to the individual requirements of each area of subject matter, much more detailed course outlines similar

to that of the Machine Shop 50 class will be prepared by individual instructors.

Design of the Product

The product of this project is a series of course outlines in each of the major areas listed. The format of the outlines is as follows:

- I. A brief description of the class, units, and how many hours of lecture and laboratory.
- II. A statement of the objectives that the course will meet.
- III. A list of text, author, publisher, and any other reference material.
- IV. A brief outline of the major components of the class and the appropriate number of hours to be spent in each area.
- V. The methods of instruction shall state the use of lecture, demonstration, media presentations, special projects, or guest speakers from a recognized area of expertise.
- VI. The methods of evaluation shall list what is to be used to establish a letter grade or credit in the course.

Limitations

This project addresses the needs of businesses and the public sector in the Riverside/San Bernardino area and not necessarily be useful in larger, industrialized areas of California such as Los Angeles County, Orange County or the San Diego County areas. Another factor which limits use of this material is the lack of formal course outlines like the one for Machine Shop 50. Each of the remaining areas must have the detailed teaching outlines done by instructors who have the technical expertise necessary to address the subject matter properly. Because of the scope of the training, it will be necessary for specialists from industry to assist in the instructional program.

The distribution of this material will depend upon the specific needs of each industrial and the public sector of a particular geographic area. This material is prepared for and limited to use at the post-secondary level. The final limitation is the availability of industrial type equipment for use in the instructional process. This may be overcome by developing strong linkages with local industries at the time this program is initiated.

RIVERSIDE CITY COLLEGE
COURSE OUTLINE FOR
MACHINE SHOP 50
(Complete Course Outline)

COURSE DESCRIPTION

50 Metal Removal 4 units

Prerequisite: None.

Basic machine tools, industrial safety, part routing, layout, metrology and common industrial metals - their alloys, heat treatment and machineability. The theory and practices of drill press, lathe and milling machine operations are emphasized. An overview of numerical control machining is given. Total of 36 hours lecture and 108 hours lab.

COURSE OBJECTIVES

Upon successful completion of this course, the student will have demonstrated knowledge of shop safety procedures, blueprint reading (beginning), proper use of hand tools, layout and bench work, calculate speeds and feeds, basic math ability, and the competencies required to perform basic operations on the power hacksaw and horizontal band saw, drill press, lathes and milling machine.

TEXT AND REFERENCES

Machine Tools and Machining Practices, Volume I, John Wiley and Sons, NY, 1977.

Elementary Blueprint Reading for Machinists, David L. Taylor, Delmar Publishers, Inc., NY, 1981.

COURSE CONTENT

	<u>HOURS</u>
Introduction to Machine Shop Safety	
Hand Tools	4
Layout and Bench Work	8
Off Hand Tool Grinding	8
Math Review	6
Calculate Speeds and Feeds	4
Lathes	50
Blueprint Reading (Elementary)	8
Drill Press	12
Milling Machine	50

METHODS OF INSTRUCTION

Lectures and demonstrations by instructor or guest speakers.

Laboratory projects and special projects.

Multimedia presentations.

METHODS OF EVALUATION

Quizzes and examinations.

Laboratory projects.

Attendance and ability to adapt to laboratory situations.

Homework.

MACHINE SHOP 50

COURSE CONTENT

I. Machine Shop Safety

A. Safety test

B. Shop orientation

1. Tour of facilities
2. Types of equipment
3. Projects to be machined

II. Engine Lathes

A. Nomenclature

1. Head stock
2. Tail stock
3. Carriage assembly
4. Bed ways
5. Quick change gear box and lead screw
6. Power transmission
 - a. Belt driven
 - b. Chain driven

B. Chucks

1. Mounting methods
 - a. Threaded spindle nose
 - b. Tapered key spindle nose
 - c. Cam lock spindle nose

C. Selecting spindle speeds

1. Belt driven
2. Gear driven
3. Variable speed
 - a. Back gear selections

D. Selecting feed rates

1. Quick change gear box
 - a. Tumbler alignment
 - b. Gear alignment

E. Universal chucks

1. Two jaw chucks
2. Three jaw chucks
3. Six jaw chucks
 - a. Scroll
 - b. Pinion gear
 - c. Master jaws

F. Independent chuck

1. 4 jaw chuck
 - a. Pinion
 - b. Master jaws

G. Holding work in a chuck

1. Three jaw chuck
2. Four jaw chuck

- a. Truing work
- 3. Collet chucks

H. Lathe centers

- 1. Head stock
- 2. Tail stock
- 3. Aligning centers

I. Work operations in a lathe

- 1. Turning operations
- 2. Facing operations
 - a. Cutting shoulders
- 3. Center drilling
 - a. Center drill sizes
- 4. Drilling operations
 - a. Straight shank drills
 - b. Taper shank drills
- 5. Reaming operations
- 6. Knurling operations
 - a. Diamond
 - b. Straight
- 7. Boring operations
 - a. Boring tools
- 8. Cut-off operations
 - a. Parting-off
 - b. Undercutting
 - c. Groove or necking

9. Taper turning
 - a. Using the compound rest
 - b. Offset centers
 - c. Taper attachments
10. External thread cutting
 - a. Right hand threads
 - b. Left hand threads
11. Internal thread cutting
 - a. Right hand threads
 - b. Left hand threads

III. Layout Operations

- A. Surface plates
 1. Materials
 2. Cleaning a surface plate
- B. Layout with a combination set
 1. Parts of a combination set
 - a. Blade
 - b. Square head
 - c. Protractor
 - d. Center head
 2. Punches used
 - a. Prick punch
 - b. Center punch
- C. Layout with surface gage
 1. Use of fine adjustment screw

- a. The scribe

D. Layout with a vernier height gage

1. Parts of a vernier height gage

- a. Vernier scale
- b. Base
- c. Head

IV. Bench Operations

A. Hand hacksaw

1. Blade selection

- a. 14 teeth
- b. 18 teeth
- c. 24 teeth
- d. 32 teeth

B. Proper use of a hand hacksaw

1. Strokes for cutting off

- a. 40-60 strokes per minute

C. Proper use of a hand file

1. Types of files

- a. Rectangular
- b. Square
- c. Round
- d. Half round
- e. Triangular

- f. Knife edge
 - g. Oval
- 2. Types of teeth
 - a. Single-cut
 - b. Double-cut
- 3. Cleaning a file
 - a. File card

D. Threading operations

- 1. Using taps
 - a. Taper
 - b. Plug
 - c. Bottoming
 - d. Serial taps
- 2. Tap drill hole
 - a. Percentage of thread
 - b. Tap drill selection
- 3. Selecting dies and stocks
 - a. Split dies
 - b. Adjustable dies
 - c. Solid dies

E. Hand reaming

- 1. Use of a hand reamer

V. Pedestal Grinders

A. Nomenclature

1. Tool rest
2. Wheel guard
3. Spark deflector
4. Safety shield
5. Motor

B. Grinding lathe tool bits

1. Right hand tools
2. Left hand tools
3. Threading tools

C. Wheel selection

1. Size
2. Bonding agents
3. Grit size
4. Grade
5. Abrasive selection

D. Mounting a grinding wheel

1. Removal of wheel
2. Mounting a wheel
 - a. Testing a wheel before mounting

E. Dressing a grinding wheel

1. Types of dressers
 - a. Abrasive wheel
 - b. Star wheel
 - c. Diamond

2. Wheel truing
 - a. Out of round wheels
3. Wheel dressing
 - a. Loaded wheel
 - b. Sharpening

F. Drill sharpening

1. Lip angles
2. Clearance angles
3. Web thickness
4. Checking angles
 - a. Drill gage
 - b. Protractor

VI. Contour Bandsaws

A. Nomenclature

1. Speed selector
2. Band width selector
3. Motor switch
4. Hi-Low speed selector
5. Variable speed indicator
6. Work table
7. Saw blade guides
8. Blade protectors

B. Selecting a saw blade

1. Type of teeth

- a. Raker set
 - b. Wave set
 - c. Straight set
- 2. Selecting teeth per inch
 - a. Material
- 3. Cutting radii
 - a. Size of radii
- C. Mounting a contour saw blade
 - 1. Blade guides
 - a. Proper clearance
 - 2. Blade tension
 - a. Blade width
- D. Sawing shapes
 - 1. Flat work
 - 2. Round work

VII. Drill Presses

- A. Parts of a drill press
 - 1. Table
 - 2. Spindle
 - 3. Column
 - 4. Head
 - 5. Motor
 - a. Belt
 - b. Variable speed

6. Depth stop
7. Spindle feed handle

B. Types of drill presses

1. Bench models
2. Floor models
3. Radial drill presses

C. Selecting spindle speeds

1. Materials (cutting speed)
2. Drill size

D. Installation and removal of drill chuck or tools

1. Threaded type
 - a. Screw on
2. Taper type
 - a. Drifts

E. Types of operations performed on a drill press

1. Drilling
 - a. Fractional (1/64 - 6")
 - b. Letter sizes (A - Z)
 - c. Number sizes (1 - 80) (81+)
 - d. Metric sizes
2. Center drilling
 - a. Sizes
 - b. Speeds

3. Countersinking
 - a. Types of angles (60° , 82° , 90°)
 - b. Speeds
4. Counterbores and spotfacers
 - a. Types of counterbores
 - b. Types of spotfacers
5. Tapping
 - a. Hand tapping
 - b. Power tapping
6. Machine reamers
 - a. Straight shanks
 - b. Taper shanks
 - c. Straight flutes
 - d. Helical flutes

VIII. Vertical Milling Machines

A. Nomenclature

1. Table
2. Column
3. Knee
4. Quill
5. Spindle
6. Saddle
7. Cross feed handle
8. Table feed handle
9. Back gear
10. Speed selection

- a. Belt
 - b. Variable speed
- B. Mounting a mill vise
 - 1. Use of keys for alignment
 - 2. Use of a dial indicator for alignment
 - 3. T-slot size
 - a. T-nuts
 - b. T-bolts
- C. Mounting a mill collet
 - 1. Use of the draw bar
 - 2. Selecting a collet
 - a. Collet size R-8
 - 3. Aligning key in spindle with collet slot
- D. Mounting an end mill holder
 - 1. Use of the draw bar
 - 2. Aligning key in spindle with holder
 - 3. The set screw
 - a. Single set screw
 - b. Double set screw
- E. Selecting mill spindle speeds
 - 1. Direct drive
 - a. Belt adjustment
 - 2. Variable speed

3. Back gear operation
 - a. Low speed
- F. Aligning the mill work head
 1. Directions of adjustment
 - a. Right - left
 - b. In - out
 2. Use of a dial indicator
 - a. Readings 90° apart to same setting
 - b. Tightening of bolts
- G. Use of an edge finder
 1. Ball type
 2. Round type
 3. Light type (battery)
- H. Use of a fly cutter
 1. Use of lathe tool bit on the mill
 2. Use of carbide insert
 3. Use in place of regular mill cutters
- I. Use of indexing fixtures
 1. Types
 - a. Spin jig
 - b. Hardinge type
 2. Indexes
 - a. Triangles

- b. Squares
- c. Hexagon
- d. Octagon
- e. Odd sided shapes

J. Boring operations

- 1. Use of power feed
 - a. Engaging feed
 - b. Automatic stop
- 2. Boring heads
 - a. Offset type
 - b. Facing and shoulder turning

IX. Horizontal Milling Machines

A. Nomenclature

- 1. Table
- 2. Column
- 3. Base
- 4. Overarm
- 5. Saddle
- 6. Spindle
- 7. Table feed handle
- 8. Cross feed handle
- 9. Spindle start lever

B. Milling cutters

- 1. Plain slitting saw

2. Staggered tooth slitting saw
3. Plain milling cutter
 - a. Light duty
 - b. Heavy duty
4. Staggered tooth milling cutter
5. Gear milling cutter
6. Shell mill cutter
7. Side milling cutter
 - a. Single side
 - b. Double side
8. End mill
9. T-slot cutter
10. Woodruff cutter
11. Corner radius cutter
12. Convex cutter
13. Concave cutter
14. Angle cutters
 - a. Single angle
 - b. Double angle

C. Mounting a mill vise

1. Use of keys for alignment
2. Use of a dial indicator for alignment
3. T-slot size
 - a. T-nuts
 - b. T-bolts

D. Mounting and removing a milling machine arbor

1. Style "A"
2. Style "B"
3. Arbor supports
4. Use of the draw bar

E. Speeds and feeds for milling

1. Setting spindle speeds (RPM)
2. Setting table feed (IPM)
3. Calculating feed per tooth (f-r)

F. Mounting cutters in the milling machine

1. Arbor mounted cutters
2. End mill holders
3. Collets

G. Milling operations

1. Gang milling
2. Slot cutting
3. Face milling
4. Gear cutting
 - a. Gear cutter selection
 - b. Index head operation

X. Surface Grinders

A. Nomenclature

1. Table

2. Base
3. Cross feed handwheel
4. Table feed handwheel
5. Downfeed handwheel

B. Wheel selection

1. Abrasive type
2. Grit size
3. Grade
4. Structure
5. Bond type
6. Manufacturer's symbol

C. Mounting a grinding wheel

1. Checking the wheel
 - a. Ring at 90°
 - b. Check blotter
 - c. Check arbor hold size
 - d. Check diameter
 - e. Check thickness
2. Mount on spindle
 - a. Tightening arbor nut
 - b. Check run out

D. Dressing the grinding wheel

1. Use of a diamond dresser
2. Angle wheel dressing

3. Radius wheel dressing

- E. Grinding work on the surface grinder

1. Setting longitudinal trip dogs
2. Setting crossfeed trip dogs
3. Adjusting the wheel to the work piece
4. Depth of cut
5. Setting automatic feeds
 - a. Table feed
 - b. Crossfeeds
6. Use of coolant
7. Grinding shapes
 - a. Square blocks
 - b. Rectangles
 - c. Rounds
 - d. Angular surfaces

- XI. Heat Treat Operations

- A. Material Selection

1. Tool steels
2. Carbon steels
3. Nickle chromium steels
4. Molybdenum
5. Chromium steels

- B. Quenching mediums

1. Air

2. Oil
3. Water

C. Pack hardening

1. Amount of carbon
2. Temperature
3. Time
4. Depth of case
5. Quenching

D. Furnace hardening

1. Temperature
2. Time
3. Quenching
4. Drawing
 - a. Temperature
 - b. Time
 - c. Quenching

E. Testing for hardness

1. Use of a Rockwell hardness tester
2. Load weight selection
3. Penetrator selection
 - a. Diamond
 - b. Ball
4. Scale selection
 - a. Rockwell "C"

- b. Vickers
 - c. Brinell
 - d. Shore Scleroscope
- 5. Tensile strength

XII. Manufacturing Process

- A. Stamping and use of dies
- B. Casting and molding
 - 1. Die casting
 - 2. Sand casting
 - 3. Molding
 - a. Rubber
 - b. Plastic
- C. Fabricated parts
 - 1. Welded assemblies
 - 2. High volume production assembly

XIII. Introduction to Numerical Control

- A. The history of numerical control
- B. Types of machines used today
- C. Languages and information systems
- D. Work performed and time saved
- E. The evolution of computer aided design (CAD) and its interface with computer aided manufacturing (CAM)
- F. The future growth of computer integrated manufacturing (CIM)

XIV. Job Requirements

A. Employers' expectations

1. Appearance
2. Work ethic

B. State laws

1. Wages and hours
2. Workmen's Compensation
3. State Disability Insurance (SDI)
4. Cal-OSHA
5. Civil Rights Commission

C. Federal laws

1. Job discrimination
 - a. Age (40-65)
 - b. Race
 - c. Religion
 - d. Sex
2. O.S.H.A. - Occupational and Safety Health Act of 1972
3. National Labor Relations Board (NLRB)

XV. Selecting a Work Place

A. Employee benefits

1. Insurance
 - a. Medical
 - b. Dental
 - c. Vision
2. Sick leave

3. Vacation
4. Holidays
5. Profit sharing
6. Stock options
7. Retirement
 - a. Employee paid
 - b. Company paid
8. Product discounts
9. Bereavement leave
10. Military leave
11. Jury duty

B. Working conditions

1. Hours of work
2. Lighting
3. Heat and cold
4. Breaks
5. Lunch area
6. Union
7. Safety
8. Opportunity for advancement

MACHINE SHOP 50
SCHEDULE OF CLASSES

WEEK 1 Machine Shop Safety
 Safety test
 Class grade requirements
 Safety test review
 (Homework: Read Section 7)

WEEK 2 Engine Lathes
 The parts of a lathe
 Speeds and feeds
 Operations performed on a lathe
 (Homework: Read Section 2)

WEEK 3 Layout Operations
 Use of precision layout tools
 Use of micrometers and other measuring tools
 (Homework: Read Section 3)

WEEK 4 Bench Operations
 Use of hand tools
 (Homework: Read Section 4)

WEEK 5 Pedestal Grinders
 Grinding lathe tool bits
 Selecting and mounting grinding wheels
 Sharpening drills
 (Homework: Read Section 5)

WEEK 6 Contour Bandsaw
 Blade selection
 Mounting a blade
 (Homework: Read Section 6)

WEEK 7 Drill Presses
 Types of drill presses
 Drill press operations
 (Homework: Read Section 8)

WEEK 8	Mid-Term Examination Review Discussion of milling machine work
WEEK 9	Mid-Term Examination
WEEK 10	The Vertical Milling Machine The parts of the milling machine Speeds and feeds Mounting attachments (Homework: Read Section 9)
WEEK 11	The Horizontal Milling Machine The parts of the milling machine Mounting cutters Milling machine cutters Speeds and feeds (Homework: Read Section 10)
WEEK 12	Surface Grinders Wheel selection Mounting of a wheel Grinding work on the surface grinder (Homework: Read Section 11)
WEEK 13	Heat Treatment Operations Material selection Quenching mediums Pack hardening Checking hardness
WEEK 14	Manufacturing Process Production techniques
WEEK 15	Introduction to Numerical Control History of numerical control Impact upon today's manufacturing
WEEK 16	Job Requirements Employers State laws Federal laws

WEEK 17 Review of Final Examination
 Selecting a workshop
 Your future and how to prepare

WEEK 18 Final Examination

Textbook: Operations Manual for Machine Tool Technology, by
Clifford Oliver, published by John Wiley & Sons

Course Materials: 6" rule (4 R Graduations)
 Safety glasses
 3 ring notebook
 Pencils
 Shop apron (optional)

Grading System:	Project #1	65 points
	Project #2	30 points
	Project #3	60 points
	Project #4	30 points
	Project #5	100 points
	Project #6	150 points
	Project #7	100 points
	Quizzes & Participation	100 points
	Mid-Term	100 points
	Final Exam	100 points
	Homework	300 points

Your semester grade will be calculated by using the total number of points you earn from your projects, tests, and occasional quiz.

RIVERSIDE CITY COLLEGE

COURSE OUTLINE FOR

AIR CONDITIONING AND REFRIGERATION 50

(BASIC OUTLINE)

COURSE DESCRIPTION

50 Air Conditioning and Refrigeration 4 units

Prerequisite: None.

Fundamentals in basic refrigeration. The nomenclature and terminology used in industry and the basic refrigeration system. The history, physics, and chemistry of refrigeration. A total of 36 hours lecture and 108 hours lab.

COURSE OBJECTIVES

Upon successful completion of this course, the student will be able to accurately explain the operation, uses and repair of compressors, be able to accurately explain the theoretical operation of refrigerant controls, be able to demonstrate the objective and/or essay written examinations, the operation, uses and repair of electrical motors, and have a thorough knowledge of number identification class and uses of refrigerants.

TEXT AND REFERENCES

Modern Refrigeration and Air Conditioning, Althouse, Turnquist and Bracciano.

COURSE CONTENT

	<u>HOURS</u>
Compressor Construction	30
Refrigerant Controls	34
Electric Motors	35
Electric Circuit Controls	30
Refrigerants	21

METHODS OF INSTRUCTION

Lectures and demonstrations by instructor or guest speakers.
Laboratory projects and special projects.
Multimedia presentations.

METHODS OF EVALUATION

Quizzes and examinations.
Laboratory projects and assigned work.
Attendance and ability to adapt to laboratory situations.
Homework.

RIVERSIDE CITY COLLEGE
COURSE OUTLINE FOR
HYDRAULICS AND PNEUMATICS
(BASIC OUTLINE)

COURSE DESCRIPTION

50 Principles of Hydraulics and Pneumatics 3 units

Prerequisite: None.

This course will teach the fundamentals of hydraulics and pneumatics. This class shall provide the student with the basic knowledge to understand the industrial application of hydraulics and pneumatics. A total of 36 hours of lecture and 54 hours of laboratory.

COURSE OBJECTIVES

Upon successful completion of this class, the student shall be able to identify basic hydraulic and pneumatic components. The student shall also be able to inspect and repair all component parts. In addition to this, they shall be able to read bills of materials and order spare parts as required.

TEXT AND REFERENCES

Sperry Vickers Industrial Hydraulics Manual #935100A.

COURSE CONTENT

	<u>HOURS</u>
Introduction to Hydraulics and Pneumatics	10
Hydraulic and Pneumatic Piping and Sealing	10
Reservoirs and Fluid Containers	10
Hydraulic and Pneumatic Actuators	20
Controls and Valves	10
Pumps	10
Hoses	10
Graphic Symbols	5
Technical Terms	5

METHODS OF INSTRUCTION

Lecture by instructor and guest speakers
Multimedia presentations
Class problem solving
Special projects

METHODS OF EVALUATION

Quizzes and examinations
Laboratory Projects
Homework
Attendance and ability to adapt to laboratory situations

RIVERSIDE CITY COLLEGE
COURSE OUTLINE FOR
INDUSTRIAL AUTOMOTIVE 50
(BASIC OUTLINE)

GENERAL DESCRIPTION

50 Industrial Automotive Principles 4 units

Prerequisite: None.

General theory, principles and service procedures relating to an introduction to automotive maintenance with emphasis being placed upon component identification, basic functions, and minor maintenance service. Total of 36 hours of lecture and 108 hours of lab.

COURSE OBJECTIVES

Upon successful completion, the student will be able to identify components of automotive systems and explain their function.

The student will also be able to perform minor maintenance and service on the automobile and material handling equipment, and be able to demonstrate the competencies required.

TEXT AND REFERENCES

Automotive Mechanics, William H. Crouse; Eighth edition, McGraw-Hill Book Co.

COURSE CONTENT

	<u>HOURS</u>
The Automobile Systems and Principles	10
Tools, Equipment and Safety	10
Automobile Power Plant	10
Automobile Cooling System	10
Automobile Lubrication System	10
Automobile Fuel System	20
Electrical System	10
Emission Control Systems	10
Power Transmission	10
Steering, Suspension and Brake Systems	10
Auto Air Conditioning Systems	10
Propane Systems	20
Material Handling Equipment	10

METHODS OF INSTRUCTION

Lectures and demonstrations by instructor or guest speakers.
Special projects.
Multimedia presentations.

METHODS OF EVALUATION

Quizzes and examinations.
Assigned work.
Attendance.
Homework.

RIVERSIDE CITY COLLEGE
COURSE OUTLINE FOR
MAINTENANCE TECHNOLOGY 50
(BASIC OUTLINE)

COURSE DESCRIPTION

50 Industrial Electrician 4 units

Prerequisite: None.

This course is designed to provide the student with a comprehensive knowledge of industrial electrical installation procedures. Total of 36 hours lecture and 108 hours lab.

COURSE OBJECTIVES

To develop a knowledge of common industrial practices used to install and maintain an average industrial company or other business enterprise.

To develop a working knowledge of the National Electrical Code and other City and County Building Code requirements.

TEXT AND REFERENCES

Electrical Principles and Practices, 2nd edition, James Adams, McGraw-Hill.

National Electrical Code Reference Book, J.D. Garland, Prentice Hall.

COURSE CONTENT

	<u>HOURS</u>
Maintaining Basic Electrical Circuits	20
Planning and Organizing Work	10
Constructing and Maintaining Electrical Controls and Devices	20
Installing and Maintaining D-C and A-C Rotating Equipment	20
Installing and Maintaining Transformers	20
Installing and Maintaining Interior Electrical Systems	20
National Electrical Code and City and County Code Requirements	20

METHODS OF INSTRUCTION

Lectures and demonstrations by instructor or guest speaker.
Laboratory projects and special projects.
Multimedia presentations.
Homework.

METHODS OF EVALUATION

Quizzes and examinations

Laboratory projects and assigned work

Attendance, participation and ability to adapt to laboratory situations

Homework

RIVERSIDE CITY COLLEGE
COURSE OUTLINE FOR
TECHNICAL COMMUNICATIONS
(BASIC OUTLINE)

COURSE DESCRIPTION

50 Technical Communications 3 units

Prerequisite: None.

Procedures for organizing and presenting data through reports. Includes practice in writing memoranda, letters, reports, formal technical reports, and verbal presentations of technical data. This course also includes discussion and presentation of personal resume and job applications. A total of 54 hours of lecture.

COURSE OBJECTIVES

To provide the student with the knowledge of the proper written and verbal presentation of technical data in formal and informal reports including personal qualifications and data necessary to gain and maintain employment as a technician or technologist.

TEXT AND REFERENCES

Basic Technical Writing, 4th edition, Herman M. Weisman, Charles E. Merrill Publishing Company, 1980.

COURSE CONTENT

	<u>HOURS</u>
Technical Writing	24
Informal Reports	12
Formal Reports	12
Personal Qualifications Data	6

METHODS OF INSTRUCTION

Lectures by instructor or guest speaker
Special projects
Multimedia presentations
Homework

METHODS OF EVALUATION

Class writing assignments
Completion of assigned work
Quizzes and examinations
Attendance and participation

RIVERSIDE CITY COLLEGE

COURSE OUTLINE FOR

TECHNICAL MATH

(BASIC OUTLINE)

COURSE DESCRIPTION

50 Technical Math for Manufacturing Technology 3 units

Prerequisite: None.

A course in mathematical problems frequently used in technical fields. Reviews basic arithmetic, basic algebra, fractions, decimals, and basic trigonometry. The use of a scientific calculator to assist in solving formulas shall be utilized. A total of 54 hours of lecture.

COURSE OBJECTIVES

Upon successful completion of this class, the student will be able to solve arithmetic problems dealing with addition, subtraction, multiplication, and division. They shall also be able to solve formulas by using unknowns and apply this knowledge to solve triangles and other shapes. The student will also have sufficient knowledge to solve most common shop problems by use of a scientific calculator.

TEXT AND REFERENCES

Shop Math, K.E. Hoffman, John Wiley and Sons, New York, 1982.

COURSE CONTENT

	<u>HOURS</u>
Whole Numbers	8
Fractions	8
Decimals	8
Formulas	12
Calculating Geometric Shapes	12
Use of a Calculator	6

METHODS OF INSTRUCTION

Lecture
Multimedia presentations
Class problem solving
Self study

METHODS OF EVALUATION

Assigned homework
Quizzes and examinations
Participation
Attendance

RIVERSIDE CITY COLLEGE

COURSE OUTLINE FOR

WELDING 50

(BASIC OUTLINE)

COURSE DESCRIPTION

50 Metal Joining 4 units

Prerequisite: None.

This course is designed to provide the student with a comprehensive knowledge of modern metal joining processes. Total of 36 hours lecture and 108 hours lab.

COURSE OBJECTIVES

To develop an awareness for the use of metals, metal processing, joining techniques, good design, and professional craftsmanship.

To fully appreciate the modern technological advancements in metals processing, manufacturing methods and organizational management.

TEXT AND REFERENCES

Welding Skills and Practices, 5th edition, Giarchino & Weeks, American Technical Publications.

Modern Welding, 3rd edition, Althouse, Turnquist, Goodheart-Wilcox Co., Inc.

COURSE CONTENT

	<u>HOURS</u>
Arc Welding Processes, Principles and Equipment	47
Gas Welding Processes	30
Resistance Welding Processes	20
Cutting Processes	20
Elements of Welding Metallurgy	15
Cost Factors	10
Welding Symbol/Joint Design	8

METHODS OF INSTRUCTION

Lecture
Demonstrations
Laboratory work
Information and assignment hand-out sheets

METHODS OF EVALUATION

Quizzes and examinations
Laboratory projects
Attendance and ability to adapt to laboratory situations
Homework

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